A Posteriori Restoration of Block Transform-Compressed Data

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Abstract

The NASA/JPL Galileo spacecraft will use lossy data compression for the transmission of its science imagery over the low-bandwidth communication system. The technique chosen for image compression is a block transform technique based on the Integer Cosine Transform (ICT) [1], a derivative of the popular JPEG image compression standard where a computationally efficient integer cosine transform implementation replaces JPEG's discrete cosine transform (DCT). JPEG and ICT are examples of block transform-based compression schemes; the image is systematically subdivided into blocks that are individually transformed, quantized, and encoded. The compression is achieved by quantizing the transformed data which reduces the data entropy and thus facilitates efficient encoding. The distortion characteristics of block transform-based compression techniques are understandable in terms of the properties of the transform basis functions and the transform coefficient quantization error [2].

For scientific applications such as Galileo, it is particularly desirable to mitigate the quantization distortion in the decompressed image to enhance science return. Galileo's limited computational resources preclude additional processing, hence attempts at data restoration are limited to *a posteriori* processing. In this work we consider two known *a posteriori* enhancement techniques, transform coefficient adjustment [3], and low-pass filtering [4]. These techniques are adapted to ICT restoration based on a quantitative model of distortion statistics, and combined to achieve significant objective and subjective improvement in restored image fidelity compared with original data.

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References

[1] K.M. Cheung and K. Tong, "Proposed Data Compression Scheme for the Galileo S-Band Contingency Mission," Proceedings of the 1993 Space and Earth Science Data Compression Workshop, NASA Conference Publication 3191, pp. 99-109.

[2] A.F. Boden, "Quantization Distortion in Block Transform-Coded Data," these proceedings.

[3] A.J. Ahumada, Jr. and R. Horng, "Smoothing DCT Compression Artifacts", Society for Information Display International Symposium Digest of Technical Papers, v. 25, pp. 708-711.

[4] H.C. Reeve III and J.S. Lim, "Reduction of blocking effects in image coding", *Opt. Eng.*, vol. 23, no. 1, pp. 34-37, Jan. 1984.